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THE EFFECTS OF POLLUTION CONTROL ON THE NONFERROUS METALS INDUSTRIES

ZINC

Part III
The Economic Impact of Pollution
Abatement on the Industry

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CHARLES RIVER ASSOCIATES INCORPORATED · CAMBRIDGE, MASSACHUSETTS

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THE ECONOMIC EFFECTS OF POLLUTION CONTROLS ON THE NONFERROUS METALS INDUSTRY: ZINC

Prepared for
the Council on Environmental Quality

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PREFACE

This report on the economic effects of pollution controls on the zinc industry has been organized into three parts comprised of eight chapters. The three parts can be read separately or in conjunction with one another. Part I summarizes the contents of the succeeding two parts, providing a broad profile of the zinc industry and outlining the economic effects of pollution controls on the industry. The important points and conclusions of the full report are contained in the first part, with greater detail and analysis in the following two parts.

Part II comprises separate chapters on:

Trends in supply and the technology of production
Consumption
Structure of the industry
Prices
Government policies
The zinc industry in the United States

Part III is our detailed analysis of the economic effects of imposing pollution controls on the zinc industry.

Much of the information contained here was first published in Charles River Associates Incorporated, *An Economic Analysis of the Lead-Zinc Industry* (Cambridge, Mass., 1967, rivised 1969), which we prepared under contract with the General Services Administration. Data presented in this report if not otherwise attributed is taken from our GSA report.

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PART III

Chapter 8

THE ECONOMIC IMPACT OF POLLUTION ABATEMENT UPON THE ZINC INDUSTRY

The Environmental Protection Agency has proposed standards governing both the emission into the air of sulfur dioxide from lead and zinc smelters and the discharge of wastes into water sources. In addition, the EPA has estimated the costs of installing control equipment to meet these standards. It is the purpose of this final chapter to present these cost estimates and to assess the impact of such costs upon the primary zinc industry. The presentation of the cost estimates will be followed by a discussion both of probable trends in the industry that would be observed in the absence of pollution control costs, and of the effects of such costs on these trends.

Cost Estimates

Table 8-1 presents data provided by the Council on Environmental Quality showing the costs that would have to be incurred by zinc smelters to attain the standard of 90 percent removal of feed sulfur. A range of error of 10 percent lower to 100 percent higher is allowed for these costs. According to CEQ, the possibility of a 10 percent lower figure depends upon the development of new, lower-cost technology. Costs could be as much as 100 percent higher, if it turns out that the proposed technology -- limestone scrubbing -- will not provide the required degree of control without large amounts of redundant facilities or curtailment of production.

Table 8-2 presents data provided by CEQ for water pollution control costs. No range of error was provided for these estimates.

The total capital outlays for both air and water pollution over the 1972-1976 period are $66.6 million. While this is a substantial amount, these companies are large enough to be able to raise such sums if continual operation is otherwise profitable.[1]

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[1]As a very rough approximation of the capital cost per smelter, we divide the total cumulative capital outlay of $66.6 million by the eight smelters currently operating to obtain the figure of $8.3 million per smelter. Dividing this number by the 5 years over which the costs are spread gives about $1.6 million per smelter per year. Most smelters are operated by companies whose annual operating incomes are at least $50 million, though one is as low as $15 million. This smaller firm has annual capital expenditures of $4 million or more, while the larger companies make annual capital expenditures of $60 to $150 million.

Table 8-1

COSTS OF CONTROLLING SULFUR DIOXIDE EMISSIONS
AT PRIMARY ZINC SMELTERS, RELATIVE TO THE STANDARD
OF 90 PERCENT REMOVAL OF FEED SULFUR
(Millions of August 1971 Dollars)

	1972	1973	1974	1975	1976
Investment Outlays					
Cost to control existing facilities	2.04	4.07	14.24	16.28	4.07
Costs to control new facilities	3.44	3.44	3.44	3.44	3.44
TOTAL	5.48	7.51	17.68	19.72	7.51
Annual Costs					
Operation and Maintenance	.82	2.45	8.17	14.70	16.33
Interest	.29	.87	2.80	5.20	5.79
Depreciation	.20	.61	2.03	3.64	4.05
TOTAL	1.31	3.93	13.00	23.54	26.17
"Total" Costs					
Total Cash Costs[1]	6.59	10.83	29.65	39.62	29.63
Total Direct Costs[2]	6.30	9.96	25.85	34.42	25.84

[1]Investment costs plus annual costs minus depreciation.

[2]Total cash costs minus interest.

SOURCE: Council on Environmental Quality

Assumptions:
1) Because of the weak sulfur dioxide concentration of the off-gas streams of roasters and sinter machines, the proposed control method incorporates the upgrading of flues to reduce gas volumes and then limestone scrubbing to remove the sulfur dioxide.
2) The interest rate is 10 percent.
3) The growth of production is 2.2 percent per year.
4) The depreciation rate is 7 percent per year.
5) No down time for installation is envisaged.

(Table 8-1 continued on following page.)

Table 8-1 (Continued)
COSTS OF CONTROLLING SULFUR DIOXIDE EMISSIONS

Assumptions: (Continued)

6) A smelter model of zero current control, producing 92,000 tons per year, and operating at full capacity for 330 days a year, was used for the cost calculation.
7) The sulfur dioxide concentration of the smelter gas is assumed to be 2 percent.
8) Six zinc smelters were assumed to require control.

Table 8-2

COSTS OF WATER POLLUTION CONTROL FOR THE LEAD AND ZINC INDUSTRY COMBINED, RELATIVE TO THE STANDARD OF EQUIVALENT OF SECONDARY TREATMENT

(Millions of August 1971 Dollars)

	1972	1973	1974	1975	1976
Investment Outlays					
Existing Facilities	1.557	1.629	1.703	1.775	1.848
New Facilities	0.231	0.235	0.240	0.245	0.250
Total	1.788	1.864	1.943	2.020	1.098
Annual Costs					
Operation & Maintenance	0.204	0.411	0.617	0.823	1.030
Interest	0.115	0.231	0.347	0.463	0.580
Depreciation	0.071	0.143	0.217	0.289	0.362
Total	0.340	0.785	1.181	1.575	1.972
"Total" Costs					
Total Cash[1]	2.107	2.506	2.907	3.306	3.703
Total Direct[2]	1.992	2.275	2.560	2.843	3.123

[1] Investment costs plus annual costs minus depreciation.
[2] Total cash costs minus interest.

SOURCE: Council on Environmental Quality

ASSUMPTIONS:
(1) Lead and Zinc smelters would apply coagulation, sedimentation, and neutralization to 100 percent of process wastewater.
(2) The interest rate is 8 percent.
(3) The growth rate of lead production is 1.4 percent and that of zinc production is 2.2 percent per year.
(4) The depreciation rate is 5 percent per year.
(5) Some downtime for installation is included.

Estimates of 1976 annual costs of control per pound of zinc are presented in Table 8-3. The annual costs consist of the increase in operating costs and the annualized capital costs. The top line of Table 8-3 contains CEQ estimates of control costs under the assumption that all smelters in the industry share these costs equally. This assumption is probably not valid. The CEQ cost figures presented in Table 8-1 assumed that six smelters have no controls currently. It is not clear which smelters the CEQ estimates are based on, as two smelters closed in 1969, four closed in 1971, and another is scheduled to close in 1972. In any case, all low-cost producers and one high-cost producer have acid plants in operation. It appears that these producers, who account for about 60 percent of U.S. slab zinc capacity, were excluded from the group needing control. Thus the control cost estimates of Table 8-1 may apply to less than half the 1970 tonnage produced, in which case the control cost per unit of output should actually be more than double the figures of Table 8-1 and would be borne entirely by a portion of the high-cost producer group. The bottom line of Table 8-3 reflects this by halving the output to which costs will probably apply and doubling the per pound control costs. For the case in which all smelters share the industry abatement costs equally, the range of per pound control costs runs from $0.0123 for the low estimate, to $0.0135 for the middle estimate, to $0.0267 for the high estimate. For the case in which only half of zinc production capacity bears the industry abatement costs, the range runs from $0.0246 to $0.0270 to $0.0534. These

Table 8-3

ANNUAL COSTS OF SULFUR DIOXIDE EMISSION
AND WATER POLLUTION[1] CONTROL
AT PRIMARY ZINC SMELTERS IN 1976

U.S. Production To Which CEQ Control Costs Apply (Tons)	Total Annual Abatement Cost ($ million)	Middle Estimate of Abatement Cost ($ per pound)	Low Cost[3] Estimate ($ per pound)	High Cost[3] Estimate ($ per pound)
1,004,000	27.156	0.0135	0.0123	0.0267
502,000	27.156	0.0270	0.0246	0.0534

SOURCES: Tables 8-1 and 8-2

[1]The annual costs of water pollution control are given by CEQ for the combined lead and zinc industries. The figures in this table are based on the arbitrary allocation of half that combined figure to lead and half to zinc. The results are not sensitive to this allocation, as air pollution control costs for the zinc industry are larger than combined lead and zinc industry water pollution control costs by a factor of over 13.

[2]The CEQ's estimated growth rate of zinc production -- 2.2 percent per year -- is applied arithmetically to 1970 U.S. zinc output of 887,200 tons to yield the figure of 1,004,000 for output in 1976. This is the figure applying in the case that control costs are spread evenly over the entire U.S. output. For the case in which the control costs are borne by less than half of domestic capacity, the figure of 1,004,000 is divided by two to get 502,000 tons per year, which results in a doubling of the per pound cost estimates. This is a rough estimate of the per pound cost increases which will be faced by those smelters needing pollution control.

[3]The high and low cost estimates allowed the minus 10 to plus 100 percent error for air pollution control costs, and no error for water pollution control costs.

are the increases in per pound costs which would continue in the long run and which will affect producers' profit rates.[1]

The impact of these expenditures on the producers' net income will be smaller than that of ordinary capital expenditures, due to special tax and investment credit provisions for the installation of pollution control equipment. These provisions of the Tax Reform Act of 1969 permit the user to amortize the equipment over five years, regardless of its useful life. For ordinary capital expenditures the "guideline" useful life is 14 years, though a firm may arbitrarily use a useful life up to 20 percent longer or shorter than this. In either case, the user has his choice of depreciation methods and may elect to take an "extra" 20 percent depreciation in the first year of the asset's life. There is pending in Congress an investment credit providing for a tax reduction amounting to 7 percent of the cost of an asset. This is not a tax deduction but rather a reduction in the tax liability by an amount of dollars equal to 7 percent of the cost of the asset.

Probable Trends in the Zinc Market In the Absence of Pollution Controls

Consumption of zinc has grown at about a 1.7 percent average annual compound rate from 1950 to 1969. The

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[1]These estimates can be compared with the estimated cost increase of $0.015 presented in the U.S. Bureau of Mines Information Circular 8527, *Control of Sulfur Dioxide Emissions in Copper, Lead and Zinc Smelting*, p. 51.

strongest component of total zinc consumption has been the zinc die casting market, whose growth rate averaged 3.6 percent over the same period. Die casting use grew much more rapidly up to a maximum of 638,000 tons in 1965, from which it declined to 535,000 tons in 1967. This decline can be attributed both to a decrease in the number of automobiles produced and to an increase in the use of injection-molded plastics. Zinc die casting consumption then increased in 1968 and 1969, but dropped off in 1970 due to abnormally low automobile production and a general economic slowdown. Thus the experience of the past five years has pulled the growth rate of zinc die casting below its normal level.

In Chapter 3 of this report it was pointed out that zinc die castings are likely to hold their own against further competitive intrusions from plastics and aluminum, in which case the die casting growth rate will probably move up to about 5 percent per year. In this case, the long-term growth rate of zinc consumption is likely to be nearly 4 percent per year in the absence of pollution abatement costs. A lower forecast, based on the unlikely event of substitution of injection-molded plastics to such an extent that there was no further growth in zinc die casting use, would be about 2 percent per year for long-run total zinc consumption.

U.S. zinc production may not increase in proportion to U.S. consumption. Since the late 1940's, when the United States imported less than 10 percent of its slab zinc consumption and about 20 percent of zinc ores used in production, the number of producers has decreased, concentration of the market has increased, and the foreign

share of supply has increased. The number of smelters declined from 18 in 1949 to 8 by the end of 1971, while actual tonnage produced dropped slightly in that period. About 25 percent of U.S. slab zinc consumption and about 50 percent of zinc ores used in production are now imported. Six of the smelter shutdowns have occurred within the 1969 to 1971 period, and a seventh has been announced for mid-1972. It is possible that three or four more smelters may close within the next several years, leaving only three or four smelters still in operation.

The major forces behind the decline in U.S. smelter capacity have been declining domestic ore supplies and, concomitantly, increased competition in the world market for ores and concentrates. This process has put a severe squeeze on high-cost domestic producers with poor access to ores. Other factors have exacerbated the change in ore supply sources. First, many domestic smelters are outdated and have high production costs by world standards. Some facilities currently operating were constructed around the turn of the century, and no new smelters have been built since the 1930's. Second, the major ore surplus countries, especially Canada and Mexico, are rapidly expanding their smelting capacity. Third, zinc smelting capacity is increasing rapidly in Europe and Japan, and the smelters in these areas have been attracting the output of new mines as well as ores that in the past went to the United States.

The effects of obsolescent equipment and technology, dwindling domestic ore supplies, and foreign

smelter expansion will probably continue to operate in the future. Of the eight smelters currently operating, the one which is already scheduled to be closed is the oldest domestic electrolytic plant, which cannot purchase ores competitively, and the three most likely to shut down are old horizontal retort plants in the so-call "Gas Belt" region, which also face diminishing local ore supplies. Domestic mines produced about 546,000 tons of zinc in 1970. This figure is no higher than that of the mid-1950's, even though the mining activities of such low-cost sources as Tennessee, Missouri, and New York have greatly expanded. Foreign smelter capacity is expected to expand considerably.[1]

Noncommunist world capacity outside the United States is expected to grow from its 1970 level of about 4,096,000 tons to 4,524,000 tons in 1972. If all the marginal U.S. smelters are shut down and the surviving firms maintained their current levels of output, U.S. smelting capacity would probably drop from its current level of 905,000 tons to about 540,000 tons per year over roughly the same or slightly longer time period. It is quite likely that the surviving domestic firms would expand their capacity over this period, so that

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[1]There are a number of advantages which foreign locations offer over the United States for new smelter construction. Lower transportation costs are important, either in the form of proximity to rich ore supplies or in the form of favorable water transportation of concentrates. Other factors include the proximity of sulfuric acid markets, growing end use markets, and lower labor costs. Smelter operating and pollution control costs are about the same abroad as in the United States.

domestic capacity could easily be in the range of 600,000 to 700,000 tons per year.

It is conceivable that these trends may continue until domestic slab zinc capacity is reduced to a level commensurate with domestic ore production plus some imports, as some surviving producers own part or all of some foreign ore supplies. The 1970 domestic mine output of zinc -- 546,000 tons -- is about equal to the present capacity of the four domestic smelters most likely to survive. Some of this domestic mine production, however, is attached to smelters that may close down. If these smelters do close down it will not be economic to reroute their ores to more distant smelters. This is part of the basis for the possibility that the approximate equalization of domestic mine output with domestic smelter capacity could occur with three smelters rather than with four.[1]

The price of zinc has been closely associated with average costs in real terms over the long run. Both have increased moderately in recent years, although there is no pronounced long-run trend. It appears

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[1]There is some chance that new smelter capacity may be constructed in the United States. If the current exploration and development activities arising from the 1968-1969 discoveries of major zinc deposits in in Tennessee work out favorably, new electrolytic capacity drawing on TVA electricity might be installed in that area.

One producer those smelter appears to be marginal is considering the purchase and re-opening of a smelter already shut down. The two smelters have roughly the same capacity. This could raise the number of domestic smelters to four or five.

that the operating costs of new foreign smelters are similar to those of low-cost domestic producers, and that the upward pressure on slab zinc prices from rising concentrate prices has about run its course. World smelting capacity is ample relative to consumption -- 1970 noncommunist consumption was just under 4,000,000 tons as compared with 1970 capacity of about 5,000,000 tons. There is no reason to expect much of a price increase on a deflated, long-term basis -- as a result of market trends in the absence of increased pollution control costs or trade barriers.

The Effects of Pollution Abatement Costs

Several issues are involved in assessing the impact of pollution control costs on the zinc industry. The extent to which such cost increases will be translated into an increase in the market price of zinc depends upon such factors as whether control costs fall predominantly upon high-cost producers or are shared equally by all firms, the relation between demand and capacity, the trade policies adopted by the government and the behavior of foreign producers.

Effects on Profit Margin If There is No Increase in Price

As a first step in the analysis it is useful to analyze the effects on the profit margins of zinc producers if the price of zinc does not increase as a result of pollution controls. Of course, the analysis

of the extent to which the zinc price may increase is an important part of the impact analysis, and the information developed on profit margins in this section will be used later in the analysis of the effects of the controls on price and output of zinc.

In the preceding chapter we estimated that long-run average costs for low-cost producers are in the neighborhood of $0.12 per pound. We have no similar estimates for the long-run average costs for high-cost producers. It is still possible, however, to estimate the probable impact of pollution control costs on low-cost producers and to compare this in a qualitative manner with the impact on high-cost producers. To measure the impact on profits, the cost assumptions of the preceding chapter, together with the pollution control cost estimates of the current chapter, are presented in Table 8-4. It is advisable to keep in mind that these figures are to be interpreted as being of the low-cost producers, and that there is undoubtedly some cost variation among producers within this category.

In Table 8-4 estimates of margins of price minus cost are given with and without the estimated control costs. The estimated control costs per pound assume that the costs are spread evenly over the entire industry output. As stated above, the production cost estimates of $0.12 per pound are those for low-cost producers. The table shows that under these control cost estimates, the low-cost producers would be able to absorb the cost increase without an accompanying price increase, but with considerable reduction in profits. They would be able to do so in the sense that there would probably not

Table 8-4

PRICES, ESTIMATED COSTS AND MARGINS
FOR LOW-COST ZINC PRODUCERS
(Dollars Per Pound)

	Low Estimate	Middle Estimate	High Estimate
Current Price[1]	$0.17	$0.17	$0.17
Average Cost Without Controls[2]	0.12	0.12	0.12
Control cost[3]	0.012	0.014	0.027
Average Cost With Controls[4]	0.132	0.134	0.147
Profit Margins with Controls, assuming no price increase[5]	0.038	0.036	0.023
Margins Without Controls[6]	0.05	0.05	0.05

Footnotes:

[1]The current price is that prevailing in the fall of 1971 as reported in *Metals Week*. The choice of current price is discussed in the text.

[2]Average cost consists of long-run average costs as estimated in Chapter 7 of this report.

[3]From Table 8-3.

[4]Average cost without controls plus control cost.

[5]Price minus average cost with controls.

[6]Price minus average cost without controls.

be any serious impairment of their ability to attract new capital into the industry for expansion, as the margins remaining after imposition of controls still appear to exceed -- though by a small amount -- the opportunity cost of capital which we estimated in Chapter 7. As there may be some cost variation among low-cost producers, it is possible that their profit margin would be reduced below this level for perhaps one or two producers, especially under the high estimate of control costs. This need not cause such a producer to go out of business, but it could make additional investment for expansion unattractive.

Although there are no similar estimates for high-cost producers, the estimated cost increases, unaccompanied by a substantial price increase, would probably reduce the margins below the estimated opportunity cost of capital if the disparity between high-cost and low-cost producers of zinc were as great as the disparity between the high- and low-cost producers of lead. Under the high estimate of control costs, the margin would be negative. Such a disparity may exist, considering the greater differences in smelter technology in the zinc industry than in the lead industry, but there are no actual data to support such a conclusion. In any case, it is quite likely that the high-cost sector would experience a market loss, either to foreign producers or to low-cost domestic producers. This would represent an acceleration of the existing trend.

As we pointed out in the discussion of Table 8-3, the assumption that control costs fall equally upon all smelters is probably not valid. In fact, it is likely

that all of the added control costs will be borne by a portion of the high-cost producer group, and that their control costs per unit of output will be twice as high as in the case of equally shared costs. As doubling the control costs even of low-cost producers would very probably bring the margins of some of them below the level of the opportunity cost of equity capital -- almost certainly for the high estimate of control costs -- it appears that doubling the control costs of high-cost producers would eliminate their margins altogether unless there were a price increase of about $0.03 to $0.05 per pound. This would bring the price of zinc to $0.20 to $0.22 in 1971 dollars, which is quite high relative to past trends and might well induce a substantial increase in imports or in substitution by injection molded plastics. Because the acquiescence of low-cost producers is probably required for such a price increase and because low-cost producers would be reluctant to risk such a loss of markets, a price increase of this magnitude is very unlikely.

It is apparent from the preceding discussion that the impact of pollution control costs on the industry depends as much on the portion of capacity to which the costs apply as on the error allowed by the CEQ estimate of those costs. The high estimate of abatement costs per pound under the assumption of equally shared costs is equal to the middle estimate under the assumption that only half the industry will bear the costs.

Effects on Price

The effects on profit margins were analyzed above assuming a constant price at the current level. If the price of zinc were to rise, however, the margins of producers would be less adversely affected.

In Chapter 5 of this report it was pointed out that, although demand and supply forces have prevented persistent and substantial deviations from a competitive price level in the past, the price of zinc is to a considerable extent an administered price closely related to prices in European markets. There is little doubt that low-cost producers have more influence over this price than do high-cost producers. The most important restraining influences on price are import substitutions from the relatively concentrated foreign sector and competition between zinc and plastics in the diecasting market. The low-cost domestic producers, however, will probably increase the zinc price to some extent as a result of pollution controls. Any increase in the domestic price will probably be accompanied by some decline in U.S. zinc consumption and by some increase in the import share of U.S. consumption. However, it is impossible to predict the optimal price increase -- at which the difference between gain on higher priced domestic sales and the loss on sales lost to imports is a maximum.

Given that the low-cost producers have the predominant influence on price, the issue is the magnitude of the price increase desired by the low-cost producers. If the abatement costs fall entirely on the high-cost producers, then the low-cost producers may have little or no incentive to increase prices. It is doubtful

that the high-cost producers could maintain a price increase without the acquiescence of the low-cost producers. If the abatement costs fall evenly upon all smelters, then the low-cost producers may have some incentive to increase prices. The range of price increases needed to leave low-cost producers with the same profit margins per unit of sales as in the absence of abatement cost increases -- corresponding to the range of cost estimates -- is $0.012 to $0.027 (7 to 16 percent relative to current price). Because of consequent long-run sales loss to imports or substitute materials, low-cost producers would probably not increase prices by this full amount.

Thus, although the high-cost smelters could probably expect some price increases after controls are imposed, the percentage increase in prices will almost certainly be less than the percentage increase in costs. An increase in the price of zinc of, say, one-half of the cost increase would place the price of zinc in the range of $0.176 to $0.184 (in 1970 dollars). If the control costs fall primarily on the high-cost producers, the price increase may be even less than this figure. Thus, the pollution controls may impose severe burdens on the three or four marginal smelters, and may force them to close down prematurely.

It is fairly likely that these smelters would be forced to close down anyway, but the available information is insufficient to arrive at a firm judgment about the date at which these smelters would be shut down without controls.

Employment and Balance of Payments Effects

Because the increase in the price of zinc that can be expected to follow imposition of abatement costs is small, and because the demand for zinc is not extremely elastic, the trends in zinc consumption with abatement costs will not be substantially different from those predicted in the absence of abatement costs.

It is difficult to measure precisely the net employment effects of the decline of the high-cost sector and expansion of the low-cost sector. Total U.S. zinc employment is unlikely to decrease; it may possibly increase in the major mining states of Tennessee, Missouri and New York and decline in several western states. The severity of the employment loss may be substantial in certain areas. In Montana and Oklahoma there may be relatively few employment alternatives: zinc smelters alone in these states employ over 2,000 men. Data on zinc mining is not available on a state-by-state basis. About 13,500 were employed in all mining activity in the Tulsa region in 1971 and 4,400 in Montana, a small part of which is associated with zinc. Should smelting in Idaho be discontinued, the situation would be similar. Total mining employment in Idaho is about 3,600 persons, and zinc smelter employment is about 600. The employment impact should be smaller in Texas, where there are about 450 zinc smelter employees and total mining employment numbers about 105,500. As some of these smelters obtain a portion of their concentrate supply abroad, the impact on mining employment may not be so severe.

The net impact of high-cost smelter shutdowns on the balance of payments will depend upon numerous changes and adjustments throughout the economy and cannot be ascertained by developments in the zinc industry alone. Some indication of the changes within the zinc industry can be obtained from the following considerations. The United States imported about $80,000,000 worth of ores and about $85,000,000 worth of zinc metal in 1969, while exporting a total value of about $13,000,000. Zinc metal imports will probably increase but the effect of this may be partially offset by reduced imports of concentrates, as the low-cost producers have ample low-cost domestic deposits. In addition, the probable reduction in domestic zinc production by high-cost smelters would reduce the amount of concentrates imported to these smelters. The key question is the division of any slab zinc market loss of high-cost producers among the low-cost domestic sector and the foreign producers, if in fact some or all of the high-cost domestic sector shuts down. It is very likely that low-cost producers will be able to expand their outputs, but not by enough to exclude additional imports. Using 1970 data to perform a rough calculation of the direct balance of payments impact under the most pessimistic assumptions, the additional slab zinc market available if the high-cost producers shut down would range from 365,000 to 572,000 tons. This range depends upon whether three or four domestic smelters shut down. The figures are based on the assumptions of either 428,000 or 535,000 tons of domestic production, current imports of 300,000 tons, and total domestic slab zinc consumption of 1,200,000 tons. If there were shutdowns of

this magnitude among high-cost producers and if domestic low-cost producers then were to expand their output by 25 percent -- which is not unreasonable over a span of a few years in light of the Tennessee, New York, and Missouri ore supply picture -- then domestic production could range from 535,000 to 670,000 tons. This would leave room for additional imports of 230,000 to 365,000 tons. At the current price of $340 per ton, this would mean additional import values of $78,200,000 to $124,000,000. (This increase in slab zinc imports would be partially offset by a reduction in concentrate imports.) The probable decrease in concentrate imports, the possible expansion, over several years, of low-cost producers by more than 25 percent and the possibility that there will be some continuation in the production of high-cost producers all imply that these dollar figures should be regarded as an extreme upper limit estimate.

The current 10 percent tariff surcharge on imports of zinc, if maintained to 1976, may partly offset the increase in the production costs of domestic producers caused by pollution abatement. In the less likely case of equal control costs for all smelters, abatement costs are about $0.012 to $0.027 per pound. This compares to the surcharge of about $0.01 per pound. Thus, domestic producers could raise prices to compensate for control costs by about $0.01 per pound without loss of market share to imports.

In the more likely case that control costs are borne by only about half the domestic capacity, the cost estimates range from $0.024 to $0.53 per pound. Under these

assumptions, the surcharge would, of course, provide considerably less of an offset to the increased domestic production costs and the possible exit of high-cost producers might not be prevented even by the 10 percent surcharge.

The situations will be the same if the present surcharge is replaced by equally large upward revaluations of the currencies of the foreign nations exporting to the United States. However, it is important to note that with the exception of Japan, the major exporters of zinc to the United States -- Canada, Mexico, Peru, and Australia -- are not the large balance of payments surplus countries that can be expected to have sharply revalued their currencies by 1976. If the surcharge has been dropped by 1976 while at the same time the countries exporting zinc to the United States have revalued their currencies by less than, say, 10 percent, all of the effects of pollution abatement on prices, U.S. output and employment outlined above will occur, although mitigated by whatever currency appreciation has taken place.

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